920569-905834

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the application of	:	Simon Bryden
Serial No.	:	10/054,208
Filed	:	January 22, 2002
For	:	Address Resolution Method For A Virtual Private Network, and Customer Edge Device For Implementing the Method
Examiner	:	Warner Wong
Art Unit	:	2616
Customer number	:	23644

BRIEF ON APPEAL

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This appeal is from the Examiner's final rejection dated April 12, 2006. An appropriate Notice of Appeal was submitted to the Patent and Trademark Office on August 11, 2006 with the required fee. This brief is therefore due by October 11, 2006.

Please deduct the $500 Appeal Brief fee pursuant to 37 C.F.R. §41.20 (b) (2) from Deposit Account No. 12-0913.

(i) Real Party In Interest

This application is assigned to Nortel Networks Limited who is the real party in interest.

(ii) Related Appeals and Interferences

There are no related appeals or interferences.

(iii) Status of Claims

This application was filed with twenty-eight claims, of which claims 1, 11, 20 and 25 were independent claims. During prosecution of the application, claim 26 was cancelled, leaving claims 1-25, 27 and 28 which have been finally rejected by the Examiner in the April 12, 2006 final Office Action. Claims 1-25, 27 and 28 stand finally rejected, and it is claims 1-25, 27 and 28 that are appealed. The claims are set forth in the attached Claims Appendix.

(iv) Status of Amendments

No amendments of the claims were filed following the Examiner's April 12, 2006 final Office Action. However, a response was filed with the Patent and Trademark Office on July 12, 2006 and the Examiner's Advisory Action of August 1, 2006 maintain the rejections of the claims.

(v) Summary of Claimed Subject Matter

Claim 1

Claim 1 is illustrative of the invention, and in relation to the specification and drawing, is as follows:

An address resolution method for a virtual private network (VPN) comprising customer edge (CE) devices (1-3 on the figure) each having a provider edge (PE) interface (interfaces with PEs 11-13 on the figure), wherein one of the PE interfaces (the interface 4 between CE 1 and PE 11 on the figure) has a single layer 3 address in the VPN and supports a multiplex of layer 2 virtual circuits (the two layer 2 virtual circuits identified by the VLAN ids 42 and 43 respectively on the figure) for communication with remote CE devices (2 and 3 respectively on the figure), the method comprising the steps of:

sending an address resolution request message, including a layer 3 address of a remote CE device, through said PE interface (4) over each layer 2 virtual circuit (the ones with VIDs 42 and 43) of the multiplex;

in response to reception of a message responding to said request message at said PE interface on one of the layer 2 virtual circuits (e.g. with VID=42), mapping the layer 3 address of said remote CE device to said one of the layer 2 virtual circuits.*

Claim 11

Similarly now referring to claim 11, as annotated, it is as follows:

A customer edge (CE) device (CE 1 on the figure) for a virtual private network (VPN), comprising:

- a provider edge (PE) interface (the interface 4 between CE 1 and PE 11 on the figure) having a single layer 3 address in the VPN and supporting a multiplex of layer 2 virtual circuits (the two layer 2 virtual circuits identified by the VLAN ids 42 and 43 respectively on the figure);

- means for transmitting, on each of the layer 2 virtual circuits of the PE interface (the ones with VIDs 42 and 43), an address resolution request message including a layer 3 address of a remote CE device (e.g. CE 2 on the figure) of the VPN (see paragraph [0041]); and

- means responsive to reception of an address resolution response message on one of the layer 2 virtual circuits (e.g. with VID=42), for mapping the layer 3 address of said remote CE device to said one of the layer 2 virtual circuits (see paragraph [0046]);

Claim 20

Now referring to claim 20, it is as follows:

An address resolution method for a virtual private network (VPN) provided through a shared network infrastructure (6 on the figure), the VPN comprising a plurality of customer edge (CE) devices (1-3 on the figure) each having a provider edge (PE) interface (interfaces with PEs 11-13 on the figure) for connection to the shared network infrastructure, wherein a respective layer 3 address is allocated to each CE device of the VPN, wherein the CE devices of the VPN include a first CE device (CE 1 on the figure) having a layer 3 router and a PE interface (the interface 4 between CE 1 and PE 11 on the figure) supporting a multiplex of layer 2 virtual circuits (the two layer 2 virtual circuits identified by the VLAN ids 42 and 43 respectively on the figure), wherein each of said layer 2 virtual circuits is distinguished by a respective virtual local area network identifier included in tagged data frames exchanged through said PE interface (see paragraph [0038]) and is provisioned in the shared network infrastructure for communication with a respective remote CE device of the VPN (see paragraph [0037]), the method comprising the following steps:

- transmitting an address resolution request message from the first CE device on each of the layer 2 virtual circuits of the PE interface (the ones with VIDs 42 and 43), the address

resolution request message including the layer 3 address allocated to a second CE device (e.g. CE 2 on the figure) of the VPN (see paragraph [0041]);

- in response to reception of said request message at the second CE device, returning an address resolution response message to the first CE device (see paragraph [0045]); and

- in response to reception of the response message at the first CE device, memorizing a correspondence between the layer 3 address allocated to the second CE device and the virtual local area network identifier of the layer 2 virtual circuit on which the response message is received (e.g. with VID=42) (see paragraph [0046]).

Claim 25

Finally, claim 25 is as follows:

A customer edge (CE) device(CE 1 on the figure) for a virtual private network (VPN) provided through a shared network infrastructure (6 on the figure), comprising:

- a provider edge (PE) interface (the interface 4 between CE 1 and PE 11 on the figure) having a single layer 3 address in the VPN, for connection to the shared network infrastructure, said PE interface supporting a multiplex of layer 2 virtual circuits (the two layer 2 virtual circuits identified by the VLAN ids 42 and 43 respectively on the figure), wherein each of said layer 2 virtual circuits is distinguished by a respective virtual local area network identifier included in tagged data frames exchanged through said PE interface (see paragraph [0038]) and is provisioned in the shared network infrastructure for communication with a respective remote CE device of the VPN (see paragraph [0037]);
- a layer 3 router for routing packets based on layer 3 addresses contained therein;

- means for transmitting an address resolution request message on each of the layer 2 virtual circuits of the PE interface (the ones with VIDs 42 and 43), the address resolution request message including a layer 3 address allocated to one of the remote CE devices (e.g. CE 2 on the figure) of the VPN (see paragraph [0041]); and

- means responsive to reception of an address resolution response message on the PE interface, for memorizing a correspondence between the layer 3 address allocated to said one of the remote CE devices and the virtual local area network identifier of the layer 2 virtual circuit on which the response message is received (e.g. with VID=42) (see paragraph [0046]).

(vi) Grounds of Rejection To Be Reviewed On Appeal

There are six grounds of rejection of this application to be reviewed on appeal, as follows:

1. The rejection of claims 1-5, 8-9, 11-14 and 17-18 under 35 U.S.C. §103(a) as being unpatentable over Hama (U.S. 2004/0202171) in view of Arndt (U.S. 5,708,654).

2. The rejection of claims 6 and 15 under 35 U.S.C. §103(a) as being unpatentable over Hama in view of Arndt and further in view of Belser (U.S. 6,151,324).

3. The rejection of claims 7 and 16 under 35 U.S.C. §103(a) as being unpatentable over Hama in view of Arndt and further in view of the Fairhurst publication.

4. The rejection of claims 10 and 19 under 35 U.S.C. §103(a) as being unpatenable over Hama in view of Arndt and further in view of Mo (U.S. 2002/0181477).

5. The rejection of claims 20-23 and 24-28 under 35 U.S.C. §103(a) as being unpatentable over Hama in view of Arndt and further in view of Belser.

6. The rejection of claim 24 under 35 U.S.C. §103 as being unpatentable over Hama in view of Arndt and Belser as applied to claim 20, and further in view of Mo.

(vii) Argument

Ground 1

Claim 1 of the present application reads as follows (references to the figure have been added in parentheses for sake of clarity):

> *An address resolution method for a virtual private network (VPN) comprising customer edge (CE) devices (1-3 on the figure) each having a provider edge (PE) interface (interfaces with PEs 11-13 on the figure), wherein one of the PE interfaces (the interface 4 between CE 1 and PE 11 on the figure) has a single layer 3 address in the VPN and supports a multiplex of layer 2 virtual circuits (the two layer 2 virtual circuits identified by the VLAN ids 42 and 43 respectively on the figure) for communication with remote CE devices (2 and 3 respectively on the figure), the method comprising the steps of:*

sending an address resolution request message, including a layer 3 address of a remote CE device, through said PE interface (4) over each layer 2 virtual circuit (the ones with VIDs 42 and 43) of the multiplex;

in response to reception of a message responding to said request message at said PE interface on one of the layer 2 virtual circuits (e.g. with VID=42), mapping the layer 3 address of said remote CE device to said one of the layer 2 virtual circuits. **

Thus, claim 1 recites that one PE interface having a single layer 3 address in the VPN, supports a multiplex of layer 2 virtual circuits. For example, when using Ethernet as a PE interface, the layer 2 virtual circuits are identified as VID-based; that is, each layer 2 virtual circuit is designated with a VLAN ID referring to a given VLAN (see e.g. page 7, lines 2-5 ; page 8, line 10 and page 9, lines 6-7 of the application as filed). This is in accordance with the IEEE 802.1Q standard mentioned in the present application.

It is also clear in the present application that the problem posed by the prior art, and solved by the present invention, is that the virtual circuits (including VLANs with a single Ethernet interface) are interpreted by layer 3 devices as being separate layer 3 subnets, which implies a separate layer 3 interface address for each VLAN. When applied to the VPN case, where the VLAN identifier is used to map incoming traffic to remote destinations over virtual circuits, this causes an increase in provisioning and resource usage, e.g. layer 3 address space (page 3, lines 18-24 of the application as filed).

The present invention thus avoids unnecessary address space wastage, in particular by permitting the customer device to interpret a group of VLAN identifiers (VIDs) on a given PE/CE interface as a single layer 3 interface (page 3, lines 25-29 of the application as filed).

Turning now to the primary reference, Hama discloses a VPN comprising customer edge (CE) devices each having a provider edge (PE) interface (figure 27).

Paragraph 30 of Hama, identified by the Examiner in an office action, indicates that a unique VID (or VLAN ID) be assigned to each customer in order to allow data transmissions between several enterprise groups, for example (see also paragraph 29). This configuration

suggests that each PE interface supports only one layer 2 virtual circuit for communication with remote CE devices. In other words, only one layer 2 virtual circuit is provided with respect to a given CE (customer) device.

There is no suggestion, in Hama, for providing a multiplex of layer 2 virtual circuits for communication with remote CE devices with respect to a given CE device (see figure 1 for instance), although several layer 2 virtual circuits could be presented to a PE device (with respect to respective CE devices).

The Examiner indicated in the Final Office Action that what he interpreted as the layer 2 virtual circuits in Hama were the individual terminal connections within a VLAN (Hama discloses to have only one VLAN with respect to a given customer device). Such interpretation does not make sense technically. It is also in contradiction with both common knowledge of one skilled in the art and the content of the present application.

In the August 1, 2006 Advisory Action, the Examiner now states that claim 1 of the present application would not imply having several VLANs with a customer device. However, claim 1 requires a multiplex of layer 2 virtual circuits for a PE interface, which means at least two layer 2 virtual circuits that correspond to respective VLANs when using Ethernet for the PE interface. The Examiner is, therefore, in error.

The Examiner further refers to Fig. 21 of Hama to argue that Hama shows that a CE device may carry multiple VLANs. As explained in paragraphs [0009] and [0010] of Hama, SHB1 and SHB2 shown in Fig. 21 are switching hubs. In this, they cannot be considered as CE devices having PE interfaces in a VPN. Moreover, none of them includes a router, the routing function being carried out by RT. So, although it is true that several VLANs are supported by SHB1 and SHB2, they are part of a network architecture very different from the one of the present invention including a VPN and involving a PE interface having a single layer 3 address in the VPN and which supports the multiplex of layer 2 virtual circuits.

It is not possible to revise or refine the teachings of Hama to try to meet the features of the present invention, in order to conclude that Hama would render the present invention obvious. There is no reason why the prior art use of multiple VLANs by simple switching hubs as shown in Fig.21 would be included in the VPN architecture of Fig. 27, since Hama

explicitly discloses that each PE interface supports only one VLAN for communication with remote CE devices as already mentioned (paragraph 30).

Even if such a revision could have been considered by one skilled in the art, it would not have led him to the invention, because claim 1 of the present application requires that one of the CE devices has routing means (so that the corresponding PE interface can map the layer 3 address of a remote CE device to one of the layer 2 virtual circuits). (Also note that claim 20 even more explicitly recites that a CE device has a layer 3 router). Furthermore, as mentioned above, SHB1 and SHB2 shown in Fig.21 of Hama are just switching hubs, not routers.

Turning now to Arndt, Arndt mentions the ARP protocol in its background part. According to this protocol, an ARP request is broadcast to all devices on a local segment of a LAN, which requests that the device having a particular target IP respond with its MAC address. A mapping of the IP address of the target device to its MAC address is thus achieved (col. 2, l.22-31).

But in Arndt, the ARP request is sent from a source device, which is a device of a single LAN, and the ARP response is inevitably received at said source device.

By contrast, the present invention, as claimed in Claim 1, requires that an address resolution request message be sent through a PE interface over each layer 2 virtual circuit of a multiplex (i.e. over several layer 2 virtual circuits simultaneously). This differs from the case of Arndt, since several VLANs are involved.

Furthermore, in the present invention, the layer 3 address of the relevant remote CE device is mapped to the one of the layer 2 virtual circuits on which a response is received. Such mapping differs from the one disclosed in Arndt where the ARP response is received at the device of the single LAN which has sent the ARP request. There is no need, in Arndt, to check on which circuit the ARP response was received.

Therefore, neither Hama nor Ardnt, or a combination of their teachings, discloses one PE interface having a single layer 3 address in the VPN and supporting a multiplex of layer 2 virtual circuits for communication with remote CE devices. Moreover, the ARP protocol

described in Arndt does not include identification of the circuit on which the ARP response was received (by contrast with claim 1, according to which the layer 3 address of the remote CE device is mapped to the one of the layer 2 virtual circuits on which the message responding to the request message was received).

One skilled in the art would thus not have been able to replicate the subject matter of Claim 1 of the present application from the teaching of Hama and Arndt. The subject matter of Claim 1 is thus new and non obvious over Hama in view of Arndt. The same reasoning applies to Claims 11, 20 and 25. The other claims are allowable, as well, in particular since they depend on an allowable independent claim, directly or indirectly.

Therefore, the rejections of ground 1 are in error and should be reversed.

Ground 2 through Ground 6

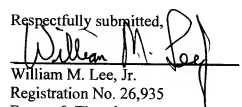
These rejections include the same combination of Hama in view of Ardnt. In view of the discussion above, the rejections of grounds 2 through 6 fall for the same reasons that the rejections of ground 1 are in error.

Conclusion

In view of the above, it is submitted that the rejections of the Examiner are clearly in error and should be reversed. Such action is therefore solicited.

September 29, 2006

Respectfully submitted,



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Claims Appendix

1. An address resolution method for a virtual private network (VPN) comprising customer edge (CE) devices each having a provider edge (PE) interface, wherein one of the PE interfaces has a single layer 3 address in the VPN and supports a multiplex of layer 2 virtual circuits for communication with remote CE devices, the method comprising the steps of:

- sending an address resolution request message, including a layer 3 address of a remote CE device, through said PE interface over each layer 2 virtual circuit of the multiplex;

- in response to reception of a message responding to said request message at said PE interface on one of the layer 2 virtual circuits, mapping the layer 3 address of said remote CE device to said one of the layer 2 virtual circuits.

2. A method as claimed in claim 1, wherein the VPN is provided through a shared network infrastructure to which the CE devices are connected by their respective PE interfaces.

3. A method as claimed in claim 2, wherein each layer 2 virtual circuit of said multiplex is provisioned in the shared network infrastructure for communication with a respective remote CE device of the VPN.

4. A method as claimed in claim 1, wherein said one of the PE interfaces having a single layer 3 address in the VPN and supporting a multiplex of layer 2 virtual circuits for communication with remote CE devices belongs to a CE device including a layer 3 router of the VPN.

5. A method as claimed in claim 1, wherein the layer 2 virtual circuits of said multiplex are distinguished by respective virtual local area network identifiers included in tagged data frames exchanged through said one of the PE interfaces.

6. A method as claimed in claim 5, wherein the step of mapping the layer 3 address of said remote CE device to one of the layer 2 virtual circuits comprises memorizing a correspondence between said layer 3 address and the virtual local area network identifier of said one of the layer 2 virtual circuits.

7. A method as claimed in claim 1, wherein the response message includes the layer 3 address of said remote CE device.

8. A method as claimed in claim 1, wherein said one of the PE interfaces is an Ethernet interface.

9. A method as claimed in claim 8, wherein the address resolution request and response messages are messages of a standard Ethernet Address Resolution Protocol (ARP).

10. A method as claimed in claim 1, wherein the VPN has a hub-and-spoke topology, with said one of the PE interfaces at a hub site and said remote CE devices at spoke sites.

11. A customer edge (CE) device for a virtual private network (VPN), comprising:

- a provider edge (PE) interface having a single layer 3 address in the VPN and supporting a multiplex of layer 2 virtual circuits;

- means for transmitting, on each of the layer 2 virtual circuits of the PE interface, an address resolution request message including a layer 3 address of a remote CE device of the VPN; and

- means responsive to reception of an address resolution response message on one of the layer 2 virtual circuits, for mapping the layer 3 address of said remote CE device to said one of the layer 2 virtual circuits.

12. A device as claimed in 11, wherein said PE interface is for connection to a shared network infrastructure in which each layer 2 virtual circuit of said multiplex is provisioned for communication with a respective remote CE device of the VPN.

13. A device as claimed in claim 11, further comprising a layer 3 router of the VPN.

14. A device as claimed in claim 11, wherein the layer 2 virtual circuits of said multiplex are distinguished by respective virtual local area network identifiers included in tagged data frames exchanged through said PE interface.

15. A device as claimed in claim 14, wherein the means for mapping the layer 3 address of a remote CE device to one of the layer 2 virtual circuits comprises means for

storing a correspondence between said layer 3 address and the virtual local area network identifier of said one of the layer 2 virtual circuits.

16. A device as claimed in claim 11, wherein the response message includes the layer 3 address of said remote CE device.

17. A device as claimed in claim 11, wherein said PE interface is an Ethernet interface.

18. A device as claimed in claim 17, wherein the address resolution request and response messages are messages of a standard Ethernet Address Resolution Protocol (ARP).

19. A device as claimed in claim 11, disposed at a hub site of the VPN having a hub-and-spoke topology.

20. An address resolution method for a virtual private network (VPN) provided through a shared network infrastructure, the VPN comprising a plurality of customer edge (CE) devices each having a provider edge (PE) interface for connection to the shared network infrastructure, wherein a respective layer 3 address is allocated to each CE device of the VPN, wherein the CE devices of the VPN include a first CE device having a layer 3 router and a PE interface supporting a multiplex of layer 2 virtual circuits, wherein each of said layer 2 virtual circuits is distinguished by a respective virtual local area network identifier included in tagged data frames exchanged through said PE interface and is provisioned in the shared network infrastructure for communication with a respective remote CE device of the VPN, the method comprising the following steps:

- transmitting an address resolution request message from the first CE device on each of the layer 2 virtual circuits of the PE interface, the address resolution request message including the layer 3 address allocated to a second CE device of the VPN;

- in response to reception of said request message at the second CE device, returning an address resolution response message to the first CE device; and

- in response to reception of the response message at the first CE device, memorizing a correspondence between the layer 3 address allocated to the second CE device and the

virtual local area network identifier of the layer 2 virtual circuit on which the response message is received.

21. A method as claimed in claim 20, wherein the address resolution response message includes the layer 3 address allocated to the second CE device, to be memorized in correspondence with the virtual local area network identifier of the layer 2 virtual circuit on which the response message is received at the first CE device.

22. A method as claimed in claim 20, wherein the PE interface is an Ethernet interface.

23. A method as claimed in claim 22, wherein the address resolution request and response messages are messages of a standard Ethernet Address Resolution Protocol (ARP).

24. A method as claimed in claim 20, wherein the VPN has a hub-and-spoke topology, said first CE device being the hub and the other CE devices being spokes.

25. A customer edge (CE) device for a virtual private network (VPN) provided through a shared network infrastructure, comprising:

- a provider edge (PE) interface having a single layer 3 address in the VPN, for connection to the shared network infrastructure, said PE interface supporting a multiplex of layer 2 virtual circuits, wherein each of said layer 2 virtual circuits is distinguished by a respective virtual local area network identifier included in tagged data frames exchanged through said PE interface and is provisioned in the shared network infrastructure for communication with a respective remote CE device of the VPN;
- a la yer 3 router for routing packets based on layer 3 addresses contained therein;
- means for transmitting an address resolution request message on each of the layer 2 virtual circuits of the PE interface, the address resolution request message including a layer 3 address allocated to one of the remote CE devices of the VPN; and
- means responsive to reception of an address resolution response message on the PE interface, for memorizing a correspondence between the layer 3 address allocated to

said one of the remote CE devices and the virtual local area network identifier of the layer 2 virtual circuit on which the response message is received.

26. (cancelled)

27. A device as claimed in claim 25, wherein the PE interface is an Ethernet interface.

28. A device as claimed in claim 27, wherein the address resolution request and response messages are messages of a standard Ethernet Address Resolution Protocol (ARP).

Evidence Appendix

There is no such appendix

Related Proceedings Appendix

There is no such appendix.